

NOTES ON COLORADO PROTOZOA

WITH DESCRIPTIONS OF NEW SPECIES

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WITH ONE PLATE

These notes have been made in the course of a systematic study of the Protozoa of the state, which was begun in the spring of 1897 and has been carried on at such times as the pressure of other duties has permitted. The work up to the present time has been confined to Greeley and its immediate vicinity, but it is hoped to extend it in the near future to other parts of the state.

Class **SARCODINA**

Order RHIZOPODA

Family AMOEBAEA LOBOSA

Genus AMOEBEA

Amoeba spatula Penard. Pl. XI, figs. 1a-1e.

A very small, floating Amoeba with long, radiating pseudopods is frequently to be found in cool, shaded waters about the city of Greeley. I have found it most abundant during the winter months in a large tank at the edge of the city park, used as a horse-trough and supplied with water from the city mains. At first I supposed it to be Ehrenberg's *A. radiosa*, and cast aside any lingering doubts that may have remained when I found it well represented by several figures in Leidy's Fresh-water Rhizopods under that name.

From the same place, and often on the same slide with the foregoing, I found a small, reptant Amoeba (fig. 1a) of slow movement.

in outline broadly spatulate or fan-shaped, its width equal to or exceeding its length, the anterior half strongly depressed, very broadly rounded, thin, and hyaline, forming a sort of broad, flat pseudopod; posterior portion thickened, granular, and filled with food vacuoles. Contractile vesicle usually one, sometimes two or three, filling and emptying very slowly. Nucleus small, round, rarely visible without reagents. This form is apparently identical with *A. spatula* Penard.

Subsequent observations proved conclusively that the two forms are merely different states of the same organism. Individuals were repeatedly seen to change from one form to the other. When about to change from the spatulate to the radiate form, the Amoeba projects from its posterior, thickened portion one or two slender pseudopods, and at the same time the broad, hyaline anterior portion is gradually withdrawn (fig. 1*b*); then several pseudopods are thrown out from what was the anterior end, the animal frees itself from the slide, and floats away (1*c*). In changing from the floating to the creeping form, this process is reversed: the long, slender pseudopods are withdrawn, the animal flattens itself upon the slide, and assumes the spatulate form.

This species attains a diameter of 10–12 μ when in the radiate, floating form, and 20–25 μ in the spatulate form. In the radiate form it may easily be mistaken for *Amoeba (Dactylosphaera) radiosa*, from which it is distinguishable by its habit of transformation.

Family GROMIINA Bütschli

Pamphagus mutabilis Bailey.

A few individuals of this apparently rare form have been seen in water from the horse-trough in the city park.

Sub-class HELIOZOA

Genus NUCLEARIA

Nuclearia delicatula Cienk.

(Syn.—*Heterophrys varians* F. E. Schulze.)

This interesting heliozoan has been found abundantly in the horse-trough in City Park, and its mode of taking food has been frequently observed. Its food consists chiefly of diatoms and uni-

cellular green algae. A pseudopod, on coming in contact with a food-particle, adheres to it and slowly contracts; as the adhering particle approaches the body, a small rounded vesicle rises up around the base of the pseudopod, into which the particle is drawn by the retraction of the pseudopod; after the particle is completely enclosed in the vesicle, this gradually subsides, carrying the particle with it into the body. Change of form in *Nuclearia*, as in most Heliozoa, is usually very slow, but occasionally a complete transformation in appearance is effected in a few minutes.

Figures of what is probably this species, from the Uinta mountains, Wyoming, are given by Leidy in his Fresh-water Rhizopods,¹ and are doubtfully referred by him to the genus *Heterophrys*. I have been unable to find any other record of the occurrence of *Nuclearia* in North America.

Class MASTIGOPHORA

Family CERCOMONADINA (Kent)

Cercomonas longicauda Duj.

In water from the horse-trough in City Park, I have frequently found a monad belonging to this genus and which accords with the figures and description of this species. I have been unable to find any prior record of the occurrence of this genus in America.

Family MENOIDINA Bütschli

Atractonema teres Stein.

Body colorless, rigid, fusiform, pointed behind, truncate or slightly emarginate anteriorly. Mouth at the anterior end opening into a distinct oesophagus which is enlarged posteriorly. Flagellum single. My specimens agreed in all respects with Stein's figure.

Hab.—Pond water, with *Euglena*. Apparently not hitherto recorded from America.

Family AMPHIMONADINA Kent

Genus *Amphimonas* Duj.

Amphimonas clavata n. sp. Pl. XI, figs. 2a, 2b.

Form elongate-clavate, broadly rounded anteriorly, tapering gradually to the posterior extremity by which it frequently fixes itself

¹ Leidy, Fresh-water Rhizopods, pl. XLV, figs. 2, 3, 5, 6.

to other objects. Body somewhat contractile. Flagella two, similar in size and character, nearly as long as the body, arising close together from the anterior extremity. Endoplasm colorless, slightly granular. Contractile vesicle single in the anterior half. Nucleus spherical, sub-central. Length 8-10 μ .

Hab.—Stale pond water.

This species closely resembles *Deltomonas cyclopum* Kent, but differs in the point of origin of the flagella. It apparently is near to *A. exilis* Perty, but differs in the flagella, which are less than half as long as in *exilis*.

Family CHLAMYDOMONADINA Bütschli

Spondylomorom quaternarium Ehrbg.

Colonies consisting of sixteen green monads, agreeing in all respects with Stein's figure and description, were abundant in June, 1898, and have since been seen occasionally.

Occurs in Europe and India; not hitherto reported from America.

Sub-class DINOFLAGELLATA Bütschli

Ceratium hirundinella (O. F. M.).

I have found this occasionally, but only in small numbers.

Peridinium tabulatum Ehrbg.

Common in clear, open water in ponds and lakes. I have found it in Seely lake, near Greeley, sometimes occurring in long streaks through the water, so abundant as to give to the water a well-marked, reddish-brown tint, perceptible at a distance of twelve to twenty meters. An average of ten counts from such a streak gave 18,300 *Peridinia* per cubic centimeter.

Class **INFUSORIA**

Order GYMNOSTOMATA Bütschli

Family ENCHELINA Ehrbg., Stein

Genus HOLOPHRYA Ehrbg.

Holophrya heterostoma n. sp. Pl. XI, fig. 3.

Form ellipsoid, about twice as long as wide; faintly striate longitudinally with about twenty striae; cilia fine, short, nearly equal, those about the anterior pole slightly larger. Mouth a narrow oval slit, rounded in front, pointed behind, lying at one side of the anterior pole. Color translucent. Usually filled with large foodballs. Nucleus oval, single, sub-central. Contractile vesicle single, posterior. Movement rather slow, regular.

Length, 100 μ .

Hab.—Ponds and ditches.

This species is a member of Section II of the genus as arranged by Bütschli. It may be readily distinguished from *H. Lieberkühni* Bütschli, the only other member of this section, by the superficial striae which are much more numerous in the latter. Bütschli gives no description of his species, but merely a figure of the anterior pole, which he copies from Lieberkühn; its remaining characteristics are therefore uncertain.

Genus UROTRICHA.

Urotricha farcta C. and L.

This species has apparently not hitherto been reported from America, but my specimens were so completely in agreement with the description and figures by European authors as to leave no doubt of their identity.

One evening, while observing through the microscope, I discovered a double *Urotricha*, a most diminutive pair of "Siamese twins." The two individuals were grown together, side by side, their long, posterior cilia extending backward parallel one with the other. Aside from the union, each appeared to be quite normally developed in every way. They were kept under observation nearly an hour, and were finally lost by their suddenly springing out of the field.

Since, in this family, reproduction commonly takes place in the encysted state, it seems probable that the "twinning" in this case was due to arrest of the process of division between two of the segments while in the cyst.

Prorodon teres Ehrbg.

I have occasionally seen infusoria which agree in every respect with Bütschli's figures of this species. It has apparently not been heretofore reported from America.

Lagynus laevis (Engelm.)?

I have found infusoria in Brown's slough, near Greeley, which apparently belong here, although less than half the size indicated by Engelmann's figure. They occurred in considerable numbers and some were found in conjugation.

Didinium nasutum (O. F. M.)

Didinium Balbiani Bütschli.

Both of these occur in abundance in Brown's slough. Neither appears to have been hitherto reported from America.

Nassula aurea Ehrbg.

This highly colored infusorian, resplendent with royal purple and gold, is often found in shallow, quiet water in the Cache la Poudre river. Apparently not hitherto reported from America.

Order TRICHOSTOMATA Bütschli

Family CHILIFERA Bütschli

Genus FRONTONIA C. & L.

Frontonia leucas Ehrbg.

Common in ponds, among diatoms and algae. Apparently not hitherto reported from America.

Frontonia elliptica n. sp. Pl. XI, figs. 4a-4d.

Form ellipsoid, slightly flattened; ends equally rounded. Body flexible, not contractile, covered with fine longitudinal striations. Cilia fine and even. Trichocysts numerous, evenly distributed. Mouth and post-oral groove extend along the second and third fifths of the body; mouth about half covered by the left undulating membrane. Contractile vesicles two, with distinct afferent radi-

ating canals. Anus postero-lateral. Macro-nucleus large, spherical, lying in the anterior half, with one or more imbedded micro-nuclei. Feeds upon diatoms.

Length 115-150 μ .

Hab.—Bottom of ponds, with algae and diatoms.

This species differs from *leucas*, with which I have found it sometimes associated, in its more symmetrical form and smaller size, in the constant presence of two contractile vesicles, in the shape of the nucleus, and in the form of the mouth and the left undulating membrane. In most of these characters it resembles *F. fusca* Quennerstedt, a marine species, from which it differs in the form of the nucleus and the position of the mouth.

Family MICROTHORACINA Wrzesni.

Cinetochilum margaritaceum (Ehrbg.)

(Syn.—*Cyclidium margaritaceum* Ehrbg.)

I have found this minute infusorian very common among algae in ponds and streams. Apparently not hitherto reported from America.

Sub-order SPIROTRICHA Bütschli

Section HETEROTRICHA Stein

Family GYROCORINA Stein

Cocnomorpha medusula Perty.

(Syn.—*Gyrocoris oxyuris* Stein.)

This rare infusorian occurred in great numbers in a jar with *Lemna* in my laboratory, in November, 1897.

Section OLIGOTRICHA Bütschli

Family HALTERINA C. & L.

Genus STROMBIDIUM C. & L.

Strombidium velox n. sp. Pl. XI, figs. 5a-5c.

Form turbinate, varying to obovate and broadly elliptical. Peristome produced backward along the ventral side as an oblique furrow, nearly to the middle line. Adoral cilia stout, curved outward and

backward, about half as long as the body, diminishing in size toward the posterior end of the oral groove. Body colorless; surface smooth, without supplementary cilia. Nucleus sub-central, irregularly globular. Contractile vesicle anterior, spherical, rather large. Food consists of diatoms.

Length, 45-50 μ . Greatest width, 37-40 μ .

Hab.—Ponds and ditches, with *Vaucheria*.

The movements are extremely rapid and erratic, the infusorian frequently gyrating for a time around a fixed point, then suddenly darting away and out of sight, even when one is using a low power. It often remains for a considerable time fixed by a slender, colorless filament to the glass or to debris on the slide, rapidly revolving on a longitudinal axis and swaying to and fro with a pendulum-like movement, in a manner quite similar to that of *Urocentrum turbo*.

The filament by means of which the animal is enabled to fix itself is apparently formed of some gelatinous substance, and is probably a secretion of the posterior portion of the animal itself. That it possesses a considerable amount of resilience and tenacity is shown by the way in which the animal is drawn backward by its contraction whenever a slowing up of the ciliary motion occurs, as well as by the comparatively enormous loads of debris which are occasionally drawn by it across the field.

A number of forms have been found which have not yet been sufficiently studied to make their identification complete; of these no further mention is made at this time. The following list contains only those forms which I have found occurring within the state and have fully identified. Of the 99 species recorded in this list, 4 are apparently new; 13 are Old World species which do not appear to have been hitherto reported as occurring in North America; the remaining 82 species embrace a few rare forms not often seen, but the greater number are well-known forms, many of them cosmopolitan in distribution.

A PRELIMINARY LIST OF THE PROTOZOA FOUND IN THE STATE OF
COLORADO

(An asterisk [*] before the name of a species indicates that it is new to America; the dagger [†] indicates a species new to science.)

Class **SARCODINA**

Order RHIZOPODA

<i>Amoeba proteus</i> (Rösel).	<i>Diffugia globulosa</i> Duj.
<i>Amoeba limax</i> Duj.	<i>Diffugia lobostoma</i> Leidy.
<i>Amoeba spatula</i> Penard.	<i>Diffugia pyriformis</i> Perty.
<i>Amoeba radiosa</i> Ehrbg.	<i>Centropyxis aculeata</i> (Ehrbg.).
<i>Arcella vulgaris</i> Ehrbg.	<i>Nebela flabellum</i> Leidy.
<i>Arcella discoides</i> Ehrbg.	<i>Euglypha alveolata</i> Duj.
<i>Diffugia acuminata</i> Ehrbg.	<i>Cyphoderia ampulla</i> (Ehrbg.).
<i>Diffugia constricta</i> (Ehrbg.).	<i>Pamphagus mutabilis</i> Bailey.
<i>Diffugia corona</i> Wallich.	

Order HELIOZOA

<i>Vampyella lateritia</i> (Fresenius).	<i>Actinophrys sol</i> Ehrbg.
<i>Nuclearia delicatula</i> Cienkowsky. (<i>Heterophrys</i> ? Leidy.)	<i>Actinosphaerium Eichenhornii</i> Ehrbg.
	<i>Raphidiophrys pallida</i> F. E. Schulze.
	Total.....22

Class **MASTIGOPHORA**

* <i>Cercomonas longicauda</i> Duj.	<i>Anisonema ovata</i> Duj.
<i>Oikomonas mutabilis</i> Kent.	† <i>Amphimonas clavata</i> n. sp.
<i>Oikomonas terino</i> (Ehrbg.).	<i>Synura uvella</i> Ehrbg.
<i>Monas guttula</i> Ehrbg.	<i>Mallomonas Plosslii</i> Perty.
<i>Anthophysa vegetans</i> (O. F. M.).	* <i>Spondylomorum quaternarium</i> Ehrbg.
<i>Euglena viridis</i> Ehrbg.	<i>Gonium pectorale</i> (O. F. M.).
<i>Trachelomonas volvocina</i> Ehrbg.	* <i>Gonium sociale</i> (Duj.).
<i>Trachelomonas hispida</i> Perty.	<i>Pandorina morum</i> Ehrbg.
<i>Phacus pleuronectes</i> (Ehrbg.).	<i>Eudorina elegans</i> Ehrbg.
* <i>Atractonema teres</i> Stein.	<i>Chilomonas paramaecium</i> Ehrbg.
<i>Peranema trichophorum</i> (Ehrbg.) Stein.	<i>Ceratium hirundinella</i> (O. F. M.).
(<i>Astasia trichophorus</i> .)	<i>Peridinium tabu'atum</i> (Ehrbg.).
	Total.....23

Class **INFUSORIA (CILIATA)**

Order GYMNSTOMATA Bütschli

<i>Holophrya discolor</i> Ehrbg.	* <i>Prorodon teres</i> Ehrbg.
† <i>Holophrya heterostoma</i> n. sp.	<i>Lacrymaria olor</i> Ehrbg.
* <i>Urotricha farcta</i> Claparede and Lachman.	(<i>Trachelocerca olor</i> .)
	* <i>Lagynus laevis</i> (Engelmann).

<i>Trachelophyllum apiculatum</i> (Perty).	<i>Lionotus fasciola</i> (Ehrbg.).
<i>Coleps hirtus</i> Ehrbg.	<i>Dileptus anser</i> (O. F. M.).
* <i>Didinium nasutum</i> (O. F. M.).	<i>Loxodes rostrum</i> (O. F. M.).
* <i>Didinium Balbiani</i> Bütschli.	* <i>Nassula aurea</i> Ehrbg.
<i>Lionotus anser</i> (Ehrbg.).	<i>Chilodon cucullus</i> (O. F. M.).

Order TRICHOSTOMATA

Sub-order ASPIROTRICHA Bütschli

<i>Glaucoma scintillans</i> Ehrbg.	<i>Paramaecium caudatum</i> Ehrbg.
* <i>Frontonia leucas</i> Ehrbg.	<i>Urocentrum turbo</i> (O. F. M.).
† <i>Frontonia elliptica</i> n. sp.	<i>Lembadion bullinum</i> Perty.
<i>Colpidium colpoda</i> Ehrbg.	(<i>Hymenostoma hymenophora</i> Stokes.)
<i>Colpoda cucullus</i> (O. F. M.).	<i>Cyclidium glaucoma</i> Ehrbg.
* <i>Cinetochilum margaritaceum</i> (Ehrbg.).	

Sub-order SPIROTRICHA Bütschli

‡ HETEROTRICHA	<i>Euplotes patella</i> (O. F. M.).
<i>Blepharisma lateritia</i> Ehrbg.	<i>Euplotes charon</i> (O. F. M.).
<i>Metopus sigmoides</i> Cl. and L.	<i>Aspidisca costata</i> (Duj.).
<i>Spirostomum ambiguum</i> Ehrbg.	‡ PERITRICHA
<i>Bursaria truncatella</i> O. F. Mueller.	<i>Vorticella aperta</i> Frommontel.
<i>Stentor coeruleus</i> Ehrbg.	<i>Vorticella convallaria</i> Ehrbg.
<i>Stentor polymorphus</i> Ehrbg.	<i>Vorticella hamata</i> Ehrbg.
<i>Coenomorpha medusula</i> Perty.	<i>Vorticella microstoma</i> Ehrbg.
(<i>Gyrocoris oxyuris</i> Stein.)	<i>Vorticella nebulifera</i> Ehrbg.
‡ OLIGOTRICHA	<i>Vorticella putrina</i> O. F. M.
† <i>Strombidium velox</i> n. sp.	<i>Vorticella similis</i> Stokes.
<i>Halteria grandinella</i> (O. F. M.).	<i>Carchesium polypinum</i> Ehrbg.
‡ HYPOTRICHA	<i>Epistylis digitalis</i> Ehrbg.
* <i>Oxytricha pelionella</i> (O. F. M.).	<i>Cothurnia crystallina</i> (Ehrbg.).
<i>Urosoma caudata</i> (Stokes).	<i>Thuricola valvata</i> (Wright).
<i>Stylonychia mytilus</i> (O. F. M.).	<i>Vaginicola decumbens</i> Ehrbg.

Total.....53

Sub-class SUCTORIA

<i>Sphaerophrya magna</i> Maupas.	1
Grand Total.....	99

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